

## CLAIMS

What is claimed:

1. A cryogenic compressor comprising: a compressor having at least one moving part for compressing a gas; an encoder for continuous position tracking of said part, said encoder comprising at least one transmit/receive unit and at least one index plate, said at least one transmit/receive unit and said at least one of said index plates are oriented such that the movement of said part is transformed by said encoder into an electronic signal representing said part's position.
2. A linear encoder as claimed in claim 1 wherein said encoder comprises analog to digital conversion circuitry and outputs digital position signals.
3. A digital linear encoder as claimed in claim 2 wherein said analog to digital conversion circuitry is located in close proximity to said read head and scale.
4. A digital linear encoder as claimed in claim 2 wherein said analog to digital conversion circuitry is separated from said read head and scale.
5. A digital linear encoder as claimed in claim 2 wherein said encoder is of an absolute-position type comprising a plurality of tracks marked on said scale. Said plurality of tracks are read by said read head as a set of digital bits creating a digital word representing one unique piston position.
6. A digital linear encoder as claimed in claim 2 wherein said encoder is of an absolute-incremental type, comprising a plurality of tracks marked on said scale. Said tracks are of different types, incremental and index tracks. Said incremental track is read by said read head to produce speed (or increments of motion per time unit) information. Said index tracks are read by said read head to produce index signals representing pre-defined absolute position. The combination of signals from said index and incremental tracks produce absolute position information at any point of said relative motion.
7. A digital linear encoder as claimed in claim 5 wherein said analog to digital conversion circuitry is located in close proximity to said read head and scale.
8. A digital linear encoder as claimed in claim 5 wherein said analog to digital conversion circuitry is separated from said read head and scale.

9. A cryogenic refrigerator having reciprocating pistons for displacing refrigeration gas and comprising linear optical encoder/encoders for continuous position tracking of said pistons. Said encoder consists of a read head and a scale. One of the said read head or scale is stationary while the other is attached to said piston to create relative motion between said read head and said scale. Said relative motion is transformed in said encoder into signals representing said piston's position.
10. A linear optical encoder as claimed in claim 9 wherein said encoder comprises analog to digital conversion circuitry and outputs digital position signals.
11. A digital optical linear encoder as claimed in claim 10 wherein said analog to digital conversion circuitry is located in close proximity to said read head and scale.
12. A digital optical linear encoder as claimed in claim 9 wherein said analog to digital conversion circuitry is separated from said read head and scale.
13. A digital optical linear encoder as claimed in claim 9 wherein said encoder is of an absolute-position type comprising a plurality of tracks marked on said scale. Said plurality of tracks are read by said read head as a set of digital bits creating a digital word representing one unique piston position.
14. A digital optical linear encoder as claimed in claim 10 wherein said encoder is of an absolute-incremental type, comprising a plurality of tracks marked on said scale. Said tracks are of different types, incremental and index tracks. Said incremental track is read by said read head to produce speed (or increments of motion per time unit) information. Said index tracks are read by said read head to produce index signals representing pre-defined absolute position. The combination of signals from said index and incremental tracks produce absolute position information at any point of said relative motion.
15. A digital optical linear encoder as claimed in claim 14 wherein said analog to digital conversion circuitry is located in close proximity to said read head and scale.
16. A digital optical linear encoder as claimed in claim 14 wherein said analog to digital conversion circuitry is separated from said read head and scale.
17. A digital optical linear encoder as claimed in claim 14 wherein said analog to digital conversion circuitry is located in close proximity to said read head and scale.

18. A digital optical linear encoder as claimed in claim 16 wherein said analog to digital conversion circuitry is separated from said read head and scale.
19. A cryogenic refrigerator having reciprocating pistons for displacing refrigeration gas and comprising linear magnetic encoder/encoders for continuous position tracking of said pistons. Said encoder consists of a read head and a scale. One of the said read head or scale is stationary while the other is attached to said piston to create relative motion between said read head and said scale. Said relative motion is transformed in said encoder into signals representing said piston's position.